JC17 Rec'd PCT/PTO 16 MAY 2001

FORM PTO-1390 (REV 10-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER CU-2505 RJS
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/831995
INTERNATIONAL APPLICATION NO. PCT/AU99/01019	INTERNATIONAL FILING DATE 17 November 1999	PRIORITY DATE CLAIMED 17 November 1998
TITLE OF INVENTION REDUCTION OF PULSATIONS IN DFB LASERS		
APPLICANT(S) FOR DO/EO/US Dmitrii STEPANOV et al		

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [X] This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)).
4. [X] The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
   b. [X] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [ ] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
7. [X] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [X] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 16 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [X] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [X] A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. [X] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [ ] Other items or information:

Express Mail Label No.:

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U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 09/831995	INTERNATIONAL APPLICATION NO PCT/AU99/01019	ATTORNEY'S DOCKET NUMBER CU-2505 RJS

	CALCULATIONS	PTO USE ONLY
17. [X] The following fees are submitted: **BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :** Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO .... **$1000.00** International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO .... **$860.00** International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO .... **$710.00** International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) .... **$690.00** International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 1000.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	23 - 20 =	3	X **$18.00**	$ 54.00	
Independent claims	1 - 3 =	0	X **$80.00**	$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$270.00**	$	
TOTAL OF ABOVE CALCULATIONS =				$ 1054.00	
[ ] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				$	
SUBTOTAL =				$ 1054.00	
Processing fee of **$130.00** for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$ 1054.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 40.00	
TOTAL FEES ENCLOSED =				$ 1094.00	
				Amount to be refunded:	$
				charged:	$

a. [X] A check in the amount of $ 1094.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. ________ in the amount of $________ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 12-0400. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Ladas & Parry
224 South Michigan Avenue
Suite 1200
Chicago, Illinois 60604
(312) 427-1300

May 16, 2001

SIGNATURE:

Richard J. Streit
NAME

25765
REGISTRATION NUMBER

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DOCKET: CU-2505

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

APPLICANT: Dmitrii STEPANOV et al)
)
TITLE: REDUCTION OF PULSATIONS IN DFB LASERS)
)
COMPLETION OF PCT/AU99/01019 filed 17 November 1999)

The Commissioner for Patents (DO/EO/US)
Box PCT
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Please amend the application being filed herewith under 35 USC 371.

IN THE CLAIMS:

Please cancel all claims from the PCT application as filed as well as claims 1-21 from the claims filed in response to the Written Opinion on October 30, 2000 and substitute new claims 22-43 as attached to the substitute specification.

REMARKS

The aforesaid claims are based on the claims as filed in response to the Written Opinion in the PCT international application, with amendments to place the same in better condition for examination under U.S. rules of practice.

Examination of this U.S. application is requested to be based on the substitute specification enclosed herewith, which is based on the following materials:

- Page 1, 4, 6 of the PCT international application as filed
- Pages 2, 3, 5 as amended in response to the Written Opinion
- Pages 7-9 of the amended claims as referenced above
- Page 10 of the abstract as filed in the PCT international application
- 4 sheets of drawings as filed in the PCT international application

Respectfully submitted,

May 16, 2001
Date

Attorney for Applicant

Richard J. Streit, Reg. 25765
c/o Ladas & Parry
224 South Michigan Avenue
Chicago, Illinois 60604
(312) 427-1300

CLAIMS:

22. A method of reducing fluctuations in the output power of a distributed feedback laser arrangement incorporating a waveguide structure having a distributed feedback region, a signal amplification region for amplifying an output of the distributed feedback region and a saturable absorption region, the method comprising using light from the distributed feedback region to induce a saturable absorption grating in the saturable absorption region.

23. A method as claimed in claim 22 when effected in a laser arrangement wherein the saturable absorption region is provided at one end of said signal amplification region.

24. A method as claimed in claim 22 when effected in a laser arrangement wherein said saturable absorption region forms part of said signal amplification portion.

25. A method as claimed in claim 22 when effected in a laser arrangement wherein said signal amplification region is in a feedback loop with said distributed feedback region.

26. A method as claimed in claim 25 wherein said feedback loop is formed by coupling a portion of an output of said signal amplification region to said distributed feedback region.

27. A method as claimed in claim 22 wherein said distributed feedback laser region is formed from Erbium doped fibre.

28. A method as claimed in claim 22 wherein said signal amplification region is formed from Erbium doped fibre.

29. A method as claimed in claim 22 wherein said saturable absorption region is formed from Erbium doped fibre.

30. A method as claimed in claim 25, wherein the feedback loop provides a phase-conjugated feedback signal to the output of the distributed feedback region.

31. A method as claimed in claim 25, wherein the feedback signal provides resonant pumping as well as saturates gain in the distributed-feedback region to the threshold value.

32. A method as claimed in claim 30, wherein the feedback signal provides resonant pumping as well as saturates gain in the distributed-feedback region to the threshold value.

33. A method as claimed in claim 22 when effected in a laser arrangement wherein a number of said distributed feedback regions are connected in series.

34. A method as claimed in claim 32, wherein one signal amplification region and one saturable absorption region and one feedback loop are shared between said distributed feedback regions to form the arrangement.

35. A method as claimed in claim 22 when effected in a laser arrangement wherein the distributed feedback region comprises a Bragg grating structure.

36. A method as claimed in claim 35, wherein the Bragg grating structure comprises a chirped Bragg grating.

37. A method as claimed in claim 35, wherein the Bragg grating structure comprises a sampled Bragg grating.

38. A method as claimed in claim 35, wherein the Bragg grating structure comprises a phase shifted Bragg grating.

39. A method as claimed in claim 35, wherein the grating structure comprises an apodised grating.

40. A method as claimed in claim 22, wherein the waveguide structure comprises a planer waveguide.

41. A method as claimed in claim 40, wherein the distributed feedback region is in the form of a planer waveguide.

42. A method as claimed in claims 40 or 41, wherein the signal amplifying region is in the form of a planer waveguide.

43. A method as claimed in any one of the claims 40 or 41, wherein the saturable absorption region is in the form of a planar waveguide.

44. A method as claimed in claim 42, wherein the saturable absorption region is in the form of a planar waveguide.

ABSTRACT

Output power fluctuations in a distributed feedback laser arrangement are reduced by inducing a saturable absorption grating in a saturable absorption region. Light is coupled into a DFB region and amplified in an amplification region. A feedback loop reflects a portion of the amplified light, and the counter-propagating beams induce an absorption grating in a saturable absorption region which suppresses output oscillations. The amplification region can comprise an erbium doped fiber, and the saturable absorption region can comprise an underpumped portion of such a fiber, or a further length of such fiber, or a planar waveguide.

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REDUCTION OF PULSATIONS IN DFB LASERS

Field of the Invention

The present invention relates to a method of reducing intensity pulsation in distributed feedback (DFB) lasers, e.g. in DFB fibre lasers.

Background of the Invention

The utilisation of optical fibre networks in telecommunications is becoming more and more prevalent due to their high bandwidth capabilities. Further, with the recent introduction of erbium doped fibre amplifiers (EDFA) wavelength division multiplexing (WDM) systems are being introduced so as to multiplex multiple channels. The increase in WDM density places more stringent requirements on the principles of operation. This requires laser transmitters with accurate wavelength selection and high wavelength stability, in addition to low power output fluctuations.

Fibre lasers such as Er-doped DFB fibre lasers in general are ideally suitable as they are fully fibre-compatible allowing for very low coupling losses. The potential of DFB fibre lasers as low noise, narrow linewidth sources for WDM systems has been demonstrated recently in digital transmission tests. Further, with a passive temperature-compensated package, the wavelength stability of DFB fibre lasers could be set better than 1 GHz within -20/+80°C temperature range.

However, due to self-pulsation in Er-doped DFB lasers, there exist power fluctuations in the output of such lasers. The origin of self-pulsations is related to ion clustering at high erbium concentrations [Sanchez et. al. Phys. Rev. A, 48(3), 2220-2229]. The clusters act as saturable absorbers with switching time much shorter than the population inversion recovery time and can eventually result in spiking behaviour of the laser.

Reducing the erbium concentration whilst still providing enough gain in a short cavity DFB fibre laser can be achieved by Yb co-doping [Kringlebotn et. al. IEEE

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Photon. Technology Letters 5(10), 1162-1164 (1993)] which increases the pumping efficiency. However, where it is desired to arrange several DFB fibre lasers in series, this method can have the disadvantage that the Yb dopant absorbs a significant portion of the pumping energy, and therefore separate pumping sources would typically be required.

Stabilisation of the laser against self-pulsations can also be accomplished by resonant pumping [Loh et al, Optics Letters 21(18), 1475-1477 (1996)] or co-pumping [Loh et. al. Optics Letters, 22(15), 1174-1176 (1997)] directly into the metastable Er-ion state, damping down the oscillations of the population inversion. However, this approach has the disadvantage that the pumping wavelength would lie close to the signal wavelength. Presently, sources for wavelengths close to commonly used signal wavelengths of around 1480 nm are quite expensive.

Summary of the Invention

The present invention provides a method of reducing fluctuations in the output power of a distributed feedback laser arrangement incorporating a waveguide structure having a distributed feedback region, a signal amplification region for amplifying an output of the distributed feedback region and a saturable absorption region, the method comprising using light from the distributed feedback region to induce a saturable absorption grating in the saturable absorption region.

The method may be effected in a laser arrangement wherein the saturable absorption region is provided at one end of said signal amplification region.

The method may be effected in a laser arrangement wherein said saturable absorption region forms part of said signal amplification portion.

The method may be effected in a laser arrangement wherein said signal amplification region is in a feedback loop with said distributed feedback region.

Said feedback loop may be formed by coupling a portion of an output of said signal amplification region to said

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distributed feedback region.

Said distributed feedback laser region may be formed from Erbium doped fibre.

Said signal amplification region may be formed from Erbium doped fibre.

Said saturable absorption region may be formed from Erbium doped fibre.

The feedback loop may provide a phase-conjugated feedback signal to the output of the distributed feedback region.

The feedback signal may provide resonant pumping as well as saturate gain in the distributed-feedback region to the threshold value.

The method may be effected in a laser arrangement wherein a number of said distributed feedback regions are connected in series.

One signal amplification region and one saturable absorption region and one feedback loop may be shared between said distributed feedback regions to form the arrangement.

The method may be effected in a laser arrangement wherein the distributed feedback region comprises a Bragg grating structure.

The Bragg grating structure may comprise a chirped Bragg grating.

The Bragg grating structure may comprise a sampled Bragg grating.

The Bragg grating structure may comprise a phase shifted Bragg grating.

The grating structure may comprise an apodised grating.

The method may be effected in a laser arrangement wherein the waveguide structure comprises a planar waveguide.

The distributed feedback region may be in the form of a planar waveguide.

The signal amplifying region may be in the form of a planar waveguide.

The saturable absorption region may be in the form of a planar waveguide.

Brief Description of the Drawings

Notwithstanding any other forms which may fall within the scope of the present invention, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is a schematic illustration of the arrangement of the preferred embodiment;

Fig. 2 illustrates the dynamics of the laser output with and without feedback;

Fig. 3 illustrates power distribution along the power amplifier at 47mW of launched 980nm pump power.

Fig. 4 illustrates the laser line width measured with and without feedback.

Description of Preferred and Other Embodiments

Turning initially to Fig. 1, there is illustrated the preferred arrangement 1 in which a 6cm long DFB structure 2 was written in an erbium doped fibre. The DFB was pumped by a 980nm pump 3. The DFB structure 2 absorbed only approximately 20% of the launched pump power producing approximately 0.5mW of output. The rest of the pump power was used to pump a section of low concentration Er-doped fibre 4. The fibre was available commercially as EDF-2 from Redfern Fibres of Australian Technology Park, Redfern, NSW, Australia. The EDF section 4 acts as a power amplifier to scale the laser output of DFB structure 2 to approximately 10mW.

The DFB master oscillator 2 was not isolated from the amplifier section 4 and its performance was affected by an intentionally induced feedback provided by a low reflectivity loop mirror 5 which was based on a coupler 6 which provided a 3% output coupler in ratio. The feedback provides a counter propagating wave in the power amplifier.

The technique of suppressing output oscillations relies on the process of saturable absorption at the end of the amplifier section 4.

Without the feedback from the mirror 5 the laser exhibited self-pulsations (curve 100 in Figure 2). With the mirror 5, however, it operates in cw mode (see curve 110 in Figure 2). As illustrated in Figure 3, a long section of the power amplifier 4 is under-pumped, i.e. it produces loss rather than gain. Accordingly, in the preferred embodiment an absorption grating can be induced in that section of the power amplifier by the interference pattern of the counter-propagating waves due to the saturable nature of absorption in Er-doped fibres. It will be appreciated, however, that alternatively a further length of Er-doped fibre or saturable absorption region in another form could be provided.

The process of four-wave mixing ensures that the feedback signal is phase-conjugated to the DFB output, eliminating the effect of environmental perturbations on the phase of the feedback signal. The four waves involved in the four-wave mixing are I) a first outgoing wave from the DFB, which interferes with II) a reflected wave from the mirror 5, and III) a further outgoing wave from the DFB, with IV) the resultant scattered wave. The amplified feedback signal provides resonant pumping as well as saturates the gain of the DFB to the threshold value, damping down relaxation oscillations in the population inversion. Additionally, the DFB is injection locked to the feedback signal which is always within the locking range of the laser.

Alternatively, the laser can be viewed as a four-mirror cavity, which can be described using the approach suggested in [Horowitz, R. Daisy, and B. Fischer, *Opt. Lett.*, 21(4), 299-301 (1996)]. In the present case the filtering effect is primarily related to the phase discrimination properties of the absorption grating which discriminates the modulation sidebands (Fig. 4) with respect to the carrier frequency since they are not necessarily correlated in phase.

It would be appreciated by a person skilled in

the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiment without departing from the spirit or scope of the invention as broadly described. The present embodiment is, therefore, to be considered in all respects to be illustrative and not restrictive.

CLAIMS:

1. A method of reducing fluctuations in the output power of a distributed feedback laser arrangement incorporating a waveguide structure having a distributed feedback region, a signal amplification region for amplifying an output of the distributed feedback region and a saturable absorption region, the method comprising using light from the distributed feedback region to induce a saturable absorption grating in the saturable absorption region.

2. A method as claimed in claim 1 when effected in a laser arrangement wherein the saturable absorption region is provided at one end of said signal amplification region.

3. A method as claimed in claim 1 when effected in a laser arrangement wherein said saturable absorption region forms part of said signal amplification portion.

4. A method as claimed in any previous claim when effected in a laser arrangement wherein said signal amplification region is in a feedback loop with said distributed feedback region.

5. A method as claimed in claim 4 wherein said feedback loop is formed by coupling a portion of an output of said signal amplification region to said distributed feedback region.

6. A method as claimed in any previous claim wherein said distributed feedback laser region is formed from Erbium doped fibre.

7. A method as claimed in any previous claim wherein said signal amplification region is formed from Erbium doped fibre.

8. A method as claimed in any previous claim wherein said saturable absorption region is formed from Erbium doped fibre.

9. A method as claimed in any one of claims 4 to 8 wherein the feedback loop provides a phase-conjugated feedback signal to the output of the distributed feedback region.

10. A method as claimed in any one of claims 4 to 9

claim where the feedback signal provides resonant pumping as well as saturates gain in the distributed-feedback region to the threshold value.

11. A method as claimed in any previous claim when effected in a laser arrangement wherein a number of said distributed feedback regions are connected in series.

12. A method as claimed in claim 11 wherein one signal amplification region and one saturable absorption region and one feedback loop are shared between said distributed feedback regions to form the arrangement.

13. A method as claimed in anyone of the preceding claims when effected in a laser arrangement wherein the distributed feedback region comprises a Bragg grating structure.

14. A method as claimed in claim 13, wherein the Bragg grating structure comprises a chirped Bragg grating.

15. A method as claimed in claims 13 or 14, wherein the Bragg grating structure comprises a sampled Bragg grating.

16. A method as claimed in any one of claims 13 to 15, wherein the Bragg grating structure comprises a phase shifted Bragg grating.

17. A method as claimed in anyone of claims 13 to 16, wherein the grating structure comprises an apodised grating.

18. A method as claimed in claim 1, wherein the waveguide structure comprises a planar waveguide.

19. A method as claimed in claim 18, wherein the distributed feedback region is in the form of a planar waveguide.

20. A method as claimed in claims 18 or 19, wherein the signal amplifying region is in the form of a planar waveguide.

21. A method as claimed in any one of claims 18 to 20, wherein the saturable absorption region is in the form of a planar waveguide.

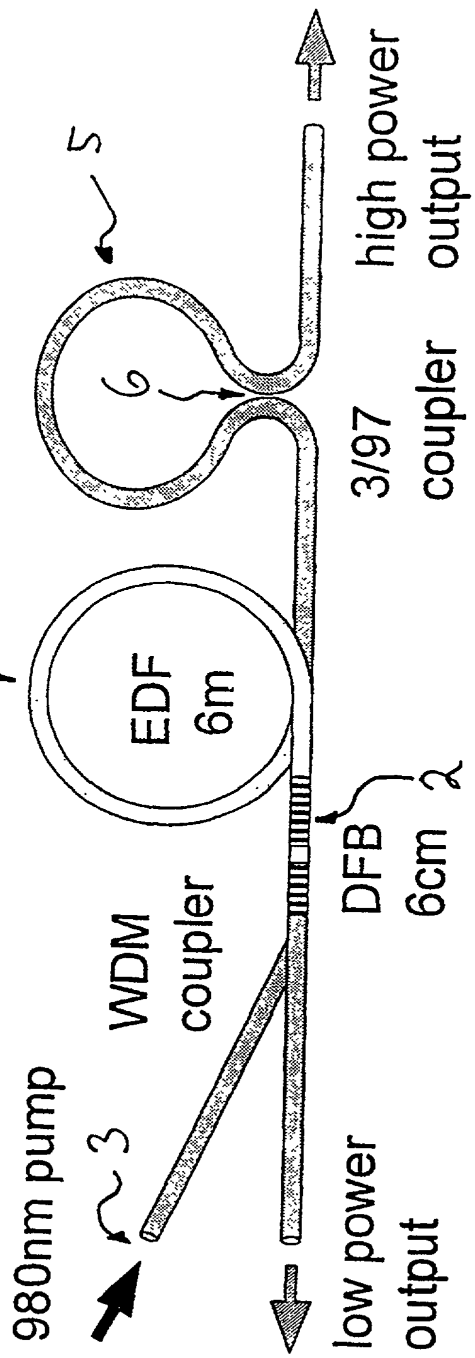
high power
output
5
6
3/97
coupler
1
4
EDF
6m
2
DFB
6cm
WDM
coupler
980nm pump
3
low power
output

Figure 1

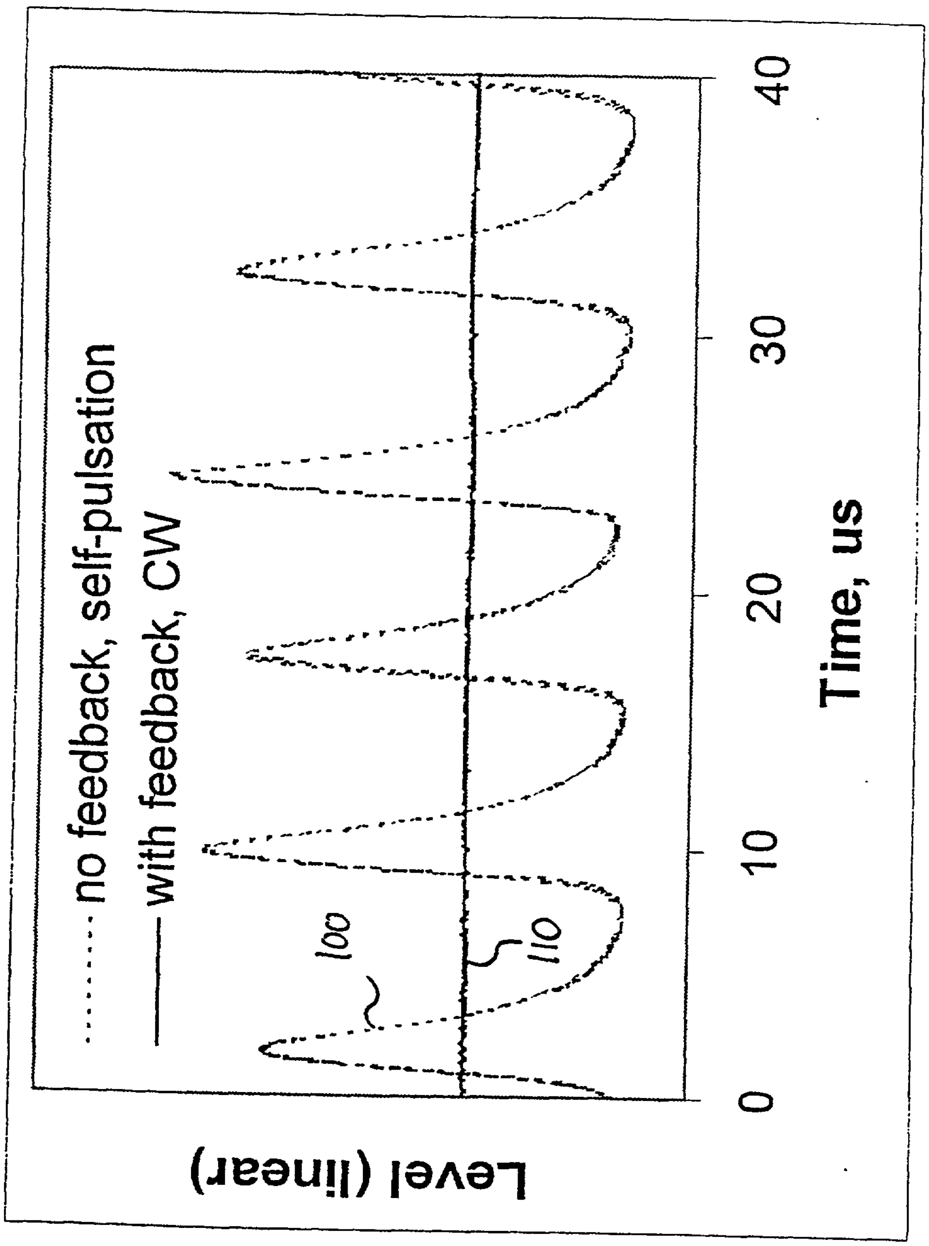
no feedback, self-pulsation
with feedback, CW
100
110
Level (linear)
0
10
20
30
40
Time, us

Figure 2

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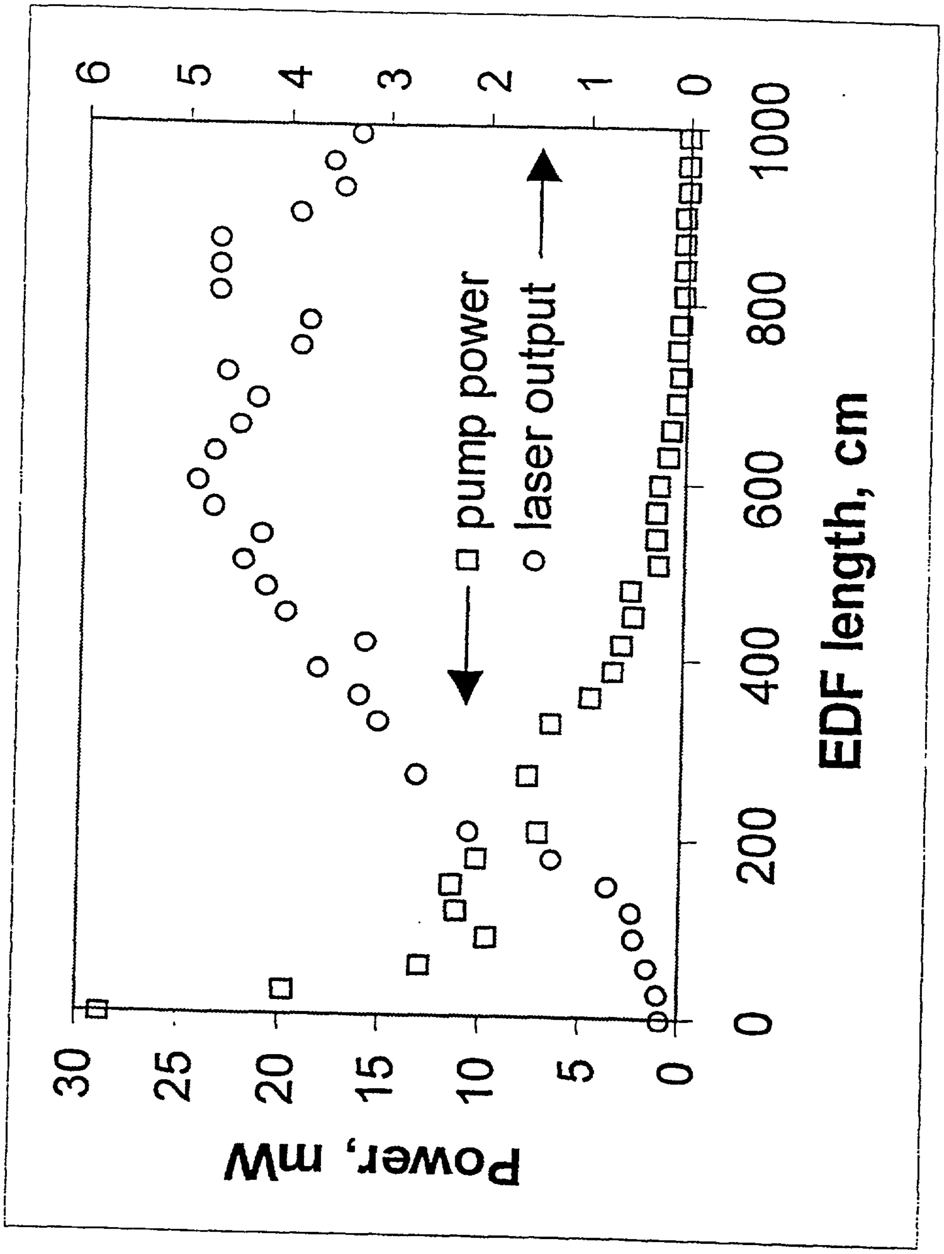

Figure 3

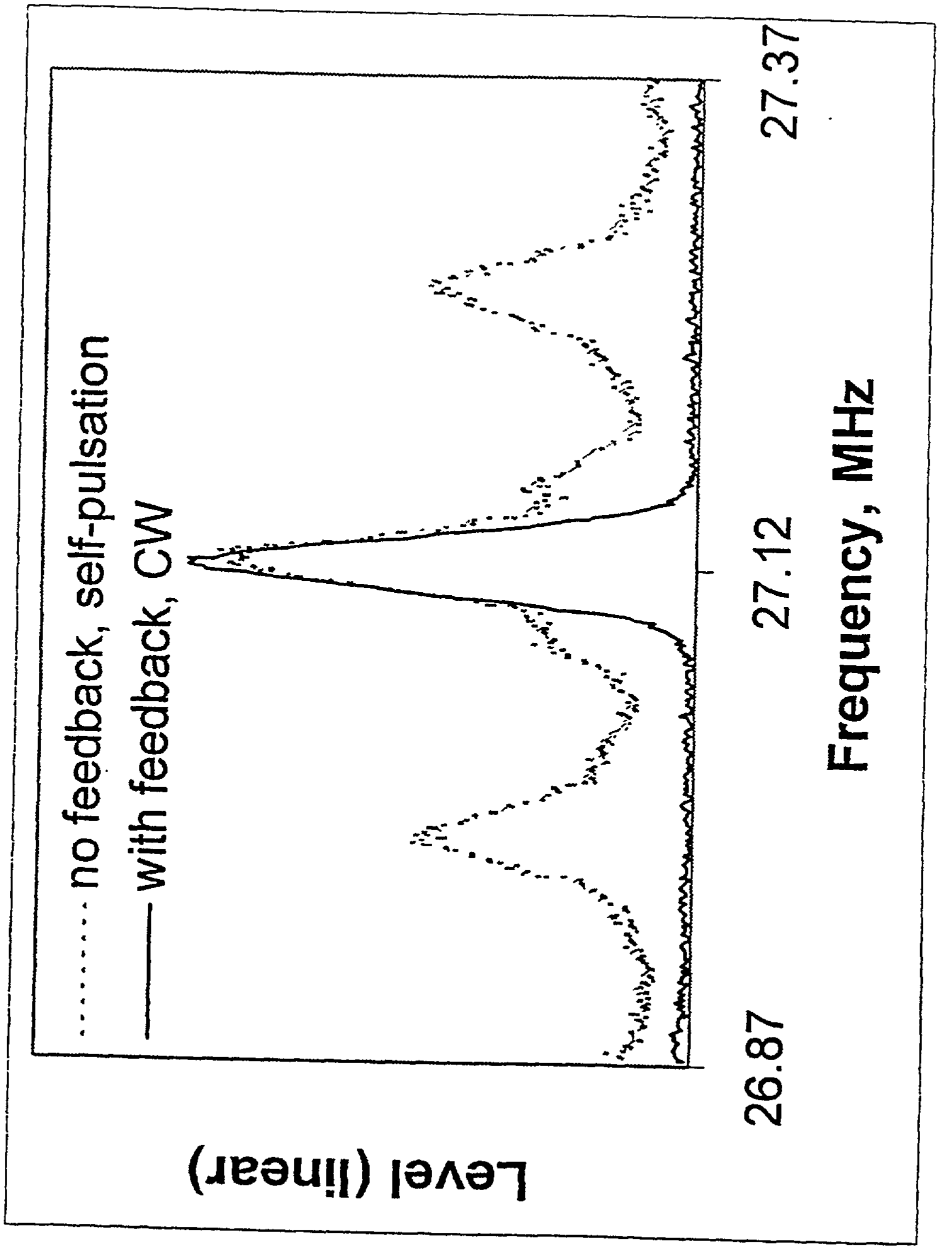
no feedback, self-pulsation
with feedback, CW
Level (linear)
26.87
27.12
27.37
Frequency, MHz

Figure 4

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PATENT

Docket: CU-2505

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR CIP)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type: *(check one applicable item below)*

- [ ] original
- [ ] design
- [ ] supplemental

Note: If the Declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

- [x] national stage of PCT

Note: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR CIP.

- [ ] divisional
- [ ] continuation
- [ ] continuation-in-part (CIP)

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

REDUCTION OF PULSATIONS IN DFB LASERS

SPECIFICATION IDENTIFICATION

the specification of which: *(complete (a), (b) or (c))*

- [ ] (a) is attached hereto.

Your Ref: CRC29

the specification of which: *(complete (a), (b) or (c))*

☐ (a) is attached hereto.

☐ (b) was filed on ______________ as ☐ Serial No. ______________ or ☐Express Mail No. *(as Serial No. not yet known)* ______________and was amended on ______________*(if applicable)*.

Note: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the Declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental Declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

☒ (c) was described and claimed in PCT International Application No. PCT/AU99/01019 filed on 17 November 1999 and as amended under PCT Article 34 on 30 October 2000.

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(also check the following items, if desired)

☐ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

☐ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 CFR 1.98.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

☐ (d) no such applications have been filed.

☒ (e) such applications have been filed as follows.

Note: Where item (c) is entered above and the international application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)

COUNTRY (OR INDICATE IF PCT	APPLICATION NUMBER	DATE OF FILING (day/month/year)	PRIORITY CLAIMED UNDER 35 USC 119
Australia	PP 7163	17 November 1998	☒ YES NO ☐
			☐ YES NO ☐
			☐ YES NO ☐

Your Ref: CRC29

			☐ YES NO ☐

Your Ref: CRC29

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(34 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER	FILING DATE

ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

Note: *If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CIP APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.*

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith *(list name and registration number)*.

12. Thomas F. Peterson, 24790; Richard J. Streit, 25765; Donald P. Reynolds, 26220; W. Dennis Drehkoff, 27193; Vangelis Economou, 32341; Brian W. Hameder, 45613; Paul B. West, 18947; Joseph H. Handelman, 26179; Peter D. Galloway 27885; John Richards, 31503; Iain C. Baillie, 24090; Richard P. Berg, 28145

☐ Attached, as part of this declaration and power of attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO:

Thomas F. Peterson
c/o Ladas & Parry
224 South Michigan Avenue
Suite 1200
Chicago, Illinois 60604

DIRECT TELEPHONE CALLS TO:
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DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

Note: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents.

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